PATENT ABSTRACTS OF JAPAN

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(71)Applicant : LSI LOGIC CORP
(72)Inventor : SNELL A PATEL
PATRICK E OBRIEN
SAMASWAMY RANGANASAN

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(54) METHOD OF FORMING PILLER TYPE GRID ARRAY PACKAGE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method of manufacturing a solder piller and a solder piller package which can be automized easily without requiring customized jig material.
SOLUTION: A flux 2 is added to a grid array package 10and the solder balls 4 of the first set are adhered to the grid package 10 in such a manner that at least some space is present between the solder balls of the first set. The solder balls 14 of the first set are flattened. Epoxy resin 18 is put in the space between the solder balls of the first setand the epoxy resin is cured. Flux 20 is added to the solder balls 14 of the first setthe solder balls 22 of the second set are bondedand a solder piller is formed. An alignment fixing means 24 is used sometimes.

CLAIMS

[Claim(s)]
[Claim 1]A method of forming a solder pillar on a grid array packagecomprising:

A step which pastes up a solder ball of the 1st group on said grid array package so that some space may exist at least between said solder balls.
A step which pastes up a solder ball of the 2nd group on a solder ball of said 1st groupand forms a solder pillar.

[Claim 2]A method by which a step which uses a filler and is filled up with space between solder balls of said 1st group in a method according to claim 1 before pasting up a solder ball of said 2nd group being included further.
[Claim 3]A methodwherein a step filled up with space between solder balls of said 1st group using a filler contains further a step filled up with space between solder balls of said 1st group using an epoxy resin in a method according to claim 2.
[Claim 4]How to carry out that a step which adds flux is included further to said grid array package with the feature in front of a step on which a solder ball of said 1st group is pasted up in a method according to claim 1.
[Claim 5]A method by which a step which carries out a reflow of the solder ball of said 1st group in a method according to claim 1 before a step on which a solder ball of said 2nd group is pasted up being included further.
[Claim 6]A method by which a step which carries out flattening of the solder ball of said 1st group in a method according to claim 1 before a step on which a solder ball of said 2nd group is pasted up being included further.
[Claim 7]How to carry out that a step which adds flux is included further to a solder ball of said 1st group with the feature in front of a step on which a solder ball of said 2nd group is pasted up in a method according to claim 1.
[Claim 8]A method by which a step which carries out a reflow of the solder ball of said 2nd group in a method according to claim 1 before a step on which a solder ball of said 2nd group is pasted up being included further.
[Claim 9]A method by which a step which carries out flattening of the solder ball of said 2nd group in a method according to claim 1 before a step on which a solder ball of said 2nd group is pasted up being included further.
[Claim 10]A method comprising according to claim 1:
A step which a step on which a solder ball of said 2nd group is pasted up adjoins a solder ball of said 1st group furtherand arranges an alignment fastener.

A step which uses said alignment fastener for a solder ball of said 1st groupand pastes up a solder ball of said 2nd group on it.

[Claim 11]A method that a solder ball of an additional group is characterized by pasting said solder pillar in a method according to claim 1 until said solder pillar becomes desired height.
[Claim 12]How forming said solder pillar in a method according to claim 11 using a solder ball up to 5 sets.
[Claim 13]A method characterized by the melting point of each additional solder ball of a group being lower than the melting point of a solder ball of a group which a solder ball of said additional group pastes up in a method according to claim 11.
[Claim 14]A methodwherein said solder ball has the liquefying temperature between about 290 to about 310 ** in a method according to claim 1.
[Claim 15]A method characterized by the melting point of a solder ball of said 1st group being higher than the melting point of a solder ball of said 2nd group in a method according to claim 1.
[Claim 16]A methodwherein said solder ball comprises lead between about 37 to about 90%and tin between about 10 to about 63% in a method according to claim 1.
[Claim 17]A group of a solder pillar forming in accordance with a method according to claim 1.
[Claim 18]A circuit containing an integrated circuit by which packaging was carried out into a package which has a solder pillar formed in accordance with a method according to claim 1 by which packaging was carried out.
[Claim 19]How to form a solder pillar on a grid array package characterized by comprising the following.
a) A step which adds flux to said grid array package.
b) A step which pastes up a solder ball of the 1st group on said grid array package so that some space may exist at least between said solder balls.
c) A step which carries out a reflow of the solder ball of said 1st group.
d) A step which carries out flattening of the solder ball of said 1st groupand a step filled up with said space between solder balls of the 1st group of e above using an epoxy resinf) A step which carries out the cure of said epoxy resinand a step which adds flux to a solder ball of the 1st group of g aboveh) a step which pastes up a solder ball of the 2nd group on a solder ball of said 1st groupand forms a solder pillarand

i -- a step which carries out a reflow of the solder ball of said 2nd group.

[Claim 20]A method that a solder ball of an additional group is characterized by pasting said solder pillar in a method according to claim 19 until said solder pillar becomes desired height.
[Claim 21]How forming said solder pillar in a method according to claim 20 using a solder ball up to 5 sets.
[Claim 22]A method characterized by the melting point of each additional solder ball of a group being lower than the melting point of a solder ball of a group which a solder ball of said additional group pastes up in a method according to claim 20.
[Claim 23]A methodwherein said solder ball has the liquefying temperature between about 290 to about 310 ** in a method according to claim 19.
[Claim 24]A method characterized by the melting point of a solder ball of said 1st group being higher than the melting point of a solder ball of said 2nd group in a method according to claim 19.
[Claim 25]A methodwherein said solder ball comprises lead between about 37 to about 90%and tin between about 10 to about 63% in a method according to claim 19.
[Claim 26]A group of a solder pillar forming in accordance with a method according to claim 19.
[Claim 27]A circuit containing an integrated circuit by which packaging was carried out into a package which has a solder pillar formed in accordance with a method according to claim 19 by which packaging was carried out.
[Claim 28]How to form a solder pillar on a grid array package characterized by comprising the following.
a) A step which adds flux to said grid array package.
b) A step which pastes up a solder ball of the 1st group on said grid array package.
c) A step which carries out a reflow of the solder ball of said 1st group.
d) A step which carries out flattening of the solder ball of said 1st groupand a step which adds flux to a solder ball of the 1st group of e abovef) A step which adjoins a solder ball of said 1st group and arranges an alignment fastenerg) a step which uses said alignment fastener for a solder ball of said 1st grouppastes up a solder ball of the 2nd group on itand forms a solder pillarand i -- a step which carries out a reflow of the solder ball of said 2nd group.

[Claim 29]A method that a solder ball of an additional group is characterized by pasting said solder pillar in a method according to claim 28 until said solder pillar becomes desired height.
[Claim 30]How forming said solder pillar in a method according to claim 29 using a solder ball up to 5 sets.
[Claim 31]A method characterized by the melting point of each additional solder ball of a group being lower than the melting point of a solder ball of a group which a solder ball of said additional group pastes up in a method according to claim 29.
[Claim 32]A methodwherein said solder ball has the liquefying temperature between about 290 to about 310 ** in a method according to claim 28.
[Claim 33]A method characterized by the melting point of a solder ball of said 1st group being higher than the melting point of a solder ball of said 2nd group in a method according to claim 28.
[Claim 34]A methodwherein said solder ball comprises lead between about 37 to about 90%and tin between about 10 to about 63% in a method according to claim 28.
[Claim 35]A method by which a step which carries out flattening of the solder ball of said 2nd group in a method according to claim 28 after a reflow of them is carried out being included further.
[Claim 36]A group of a solder pillar forming in accordance with a method according to claim 28.
[Claim 37]A circuit containing an integrated circuit by which packaging was carried out into a package which has a solder pillar formed in accordance with a method according to claim 28 by which packaging was carried out.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the field of the packaging of an integrated circuit. This invention relates to the grid array package of thermal stress (stress) resistance in detail.
[0002]
[Description of the Prior Art]Even if it is a thin film device and is a thick film devicebefore being used with other circuit elementspackaging of the integrated circuit is carried out. When an integrated circuit is

used in the environment where it has potential destructivity to the integrated circuit itselfa ceramic package is desired strongly. Such environment is the environment where itfor examplehas conditions of the fixed or extreme fluctuation between high humidity or an elevated temperaturethe combination of the bothone of theseor both.
[0003]Although the sealing seal of a ceramic package can protect an integrated circuit from environment effectivelyenvironmental conditions may become a cause and it may loosen from the circuit board in which the whole ceramic package is mounted. When a package may loosen even to such an extent that the suitable electric interengagement to the device inside a package must have been maintainedand it is done soa circuit stops operating appropriately.
[0004]One specific example of how this problem may arise is a case where a ceramic package is used in the environment where temperature swings. Typicallya ceramic package has a different coefficient of thermal expansion from the printed circuit board to which it is attached. Thereforeif an environmental temperature changesit will contract or expand by a different ratio from a package and a circuit board. According to the difference in the change size of a package and a circuit boardshearing stress (shear stress) arises in the adhesion means between a package and a circuit board.
[0005]As an adhesion means between a package and a circuit boarda solder ball is used typically. A solder ball may dissociate from either a package or a circuit board with the stress produced inside the solder ball with the passage of time. This interrupts an electrical link and produces failure of a circuit as a result as mentioned above.
[0006]In order to solve this problema solder pillar is used as a contacting means instead of a solder ball. After a solder pillar extends a remarkable distance from a packageit is connected to a circuit board. Thereforethe distance by which the shearing stress derived in a solder pillar should be absorbed becomes long. In the case of a solder pillarsince the length of the substance which changes and absorbs stress is larger than the case of a solder ballin environment large [fluctuation of temperature]or fixeda solder pillar has easily the tendency not to break down as a contacting meanslike the case of a solder ball.
[0007]
[Problem(s) to be Solved by the Invention]Howeverthe method used for producing a solder pillar also unfortunately is comparatively more expensive than the case of a solder ball. There are two or more reasons in this. For examplealthough it is custom-madeor it is placedand the

material used for forming a solder pillar is cast on a package (inch-situ) and is that either typicallythese tend to become both quite expensive. Expensive fastenerssuch as a boat (boat) holding the solder pillar and the charge of a casting material before formationmust be used in a traditional process. The traditional method of contacting a solder pillar needs the handicraft of the grade that automation is remarkable difficult therefore. The cost about an employee's wages not only increases for each processing which must be attainedbut also as a resultthe variability of a process will be largeand a scrap will increase.

[0008]Thereforethat it is required does not need the customized materialbut it is an automatable manufacturing method of a solder pillar and a solder pillar package easily. The method by which size and length were suitable for manufacture of the solder pillar changed variously is required.

[0009]

[Means for Solving the Problem]**** and the other purpose are attained by a method of forming a solder pillar on a grid array package. Flux (flux) is added to a grid array packagea solder ball of the 1st group pastes a grid array packageand it is made for some space to exist at least between solder balls in the 1st group. A reflow of the solder ball of the 1st group is carried outand flattening is carried out. Space between solder balls of the 1st group is filled up with an epoxy resinand the cure (hardening) of this epoxy resin is carried out. Flux is added to a solder ball of the 1st groupa solder ball of the 2nd group pastes a solder ball of this 1st groupand a solder pillar is formed. A reflow of the solder ball of the 2nd group is carried out. In a preferred embodimenta solder ball of further group is pasted up on a solder pillar until a solder pillar becomes desired height.

[0010]In another exampleflux is added to a grid array package and a solder ball of the 1st group pastes a grid array package. A reflow of the solder ball of this 1st group is carried outflattening is carried outand flux is added to it. An alignment (alignment) fastener adjoins a solder ball of the 1st groupand is placedand a solder ball of the 2nd group pastes a solder ball of the 1st group that has an alignment fastenerand forms a solder pillar. A reflow of the solder ball of the 2nd group is carried outand flattening is carried out. As long as it desires a solder ball of further groupit may be pasted up similarly.

[0011]Further effect of this invention becomes clear by reading the following explanation with reference to an attached drawing. Howeverin a drawinga size is not a actual passage. The same reference number is

given to the same component through two or more drawings.
[0012]
[Embodiment of the Invention]Reference of drawings shows drawing 1 some packages 10. In another various examplesalthough the package 10 is formed from materialssuch as a combination circuit board and a flex circuitin a preferred embodimentthe packages 10 are ceramics. Although not illustrated on the surface of the package 10the surface of action made to the integrated circuit (not shown [this]) where electric interengagement is packed through this orwhich is in the inside of the package 10 is arranged. Only three surfaces of action are shown after the package 10 by this example. howeverless after the package 10 in which the method of this invention is realized than itwhen actual -- or -- probably -- ** -- it will be understood that many surfaces of action may exist far.
[0013]The flux 12 is arranged on the surface of action of the package 10. Although the flux 12 is screened on the package 10 in this preferred embodimentIn another examplethe flux 12 is added using one arbitrary methods in the method of a large number usually known for this technical fieldsuch as sprayingrollingscreen paintingand brushing. The flux 12 comprises material usually used in electronic industry. The solder ball 14 of the 1st group pastes the package 10as shown in drawing 2. A diameter is for about 0.020 inch and about 0.045 inch preferablyand most preferablythe solder ball 14 is 0.030 inch and may be formed with the composition of tin and silverindiumleadand desirable various soldersuch as tin and lead. The solder ball 14 has a presentation in the range of lead between about 37 to about 90%and tin between about 10 to about 63% preferably. In a preferred embodimentthe solder ball 14 has the liquefying temperature (liquidus temperature) of about 300 ** most preferably for about 290 to about 310 **.
[0014]As shown in drawing 3a reflow of the solder ball 14 is carried out so that it may agree in the package 10 more nearly thoroughly. A reflow is attained at a temperature high about 40 ** from about 20 ** rather than the liquefying temperature of the solder ball 14. By lengthening the braid (blade) in the direction to cross etc.flattening of the solder ball 14 of the 1st group is carried outand as shown in drawing 4it is made into the height with same all.
[0015]In a preferred embodimentthe solder ball 14 of the 1st group is supported during processing after itand use with the filler 18 arranged in the space between the solder balls 14 of the 1st group as shown in drawing 5. The filler 18 is an epoxy resina silicon materialthermo plasticsor a thermoset shaping compound. The cure of the filler 18 is

carried out so that it may be required with the characteristic of a specific material used.
[0016]A suitable material is an epoxy resin (organometallic) of organic metal nature widely used in this industry. this material -- the temperature between about 125 to about 200 ** -- it is about 150 ** most suitablyand the time for about 5 minutes to about 240 minutesa cure is most suitably carried out in 120 minutesand a cure is preferably carried out in an air atmosphere.
[0017]The layer of the flux 20 is added to the solder ball 14 of the 1st groupand makes them prepared for future processings as shown in drawing 6. The solder ball 22 of the 2nd group pastes the solder ball 14 of the 1st groupas shown in drawing 7. As shown in drawing 8 as mentioned abovea reflow of the solder ball 22 of the 2nd group is carried outand it is made to make it further in agreement [solder ball] with the solder ball 14 of the 1st group.
[0018]Another presentation may be sufficient as the solder ball 22 of the 2nd group also at the same presentation as the solder ball 14 of the 1st group. In this preferred embodimentthe solder ball 22 of the 2nd group is chosen so that the melting point may become low rather than the 1st solder ball 14. In the most suitable examplethe melting point of the solder ball 22 of the 2nd group has the filler 18 lower than combustiondecompositionor the temperature that carries out a flow. This reason is for making it dissolve from other components of a packageand dissociatingwhen the problem which needs that removal and exchange about the solder ball 22 of the 2nd group arises.
[0019]It is filled up with between the groups of a solder balland the step on which the solder ball of the further group is pasted up is repeated until the solder pillar formed of the pile of the group of a solder ball becomes desired height. In this preferred embodimentthe solder ball of about two to five group is used for forming a solder pillar. As mentioned abovewhen the solder ball in which each group has been arranged one after another is preferably filled up with the space between the group of the solder ball arranged before itand the group of the solder ball arranged before itits melting point is lower than the material used as the filler 18.
[0020]When it becomes desired heightflattening of the solder pillar is carried out. The filler 18 between the solder balls of each groupPrevent them from having a tendency which supports a solder ball and fallingand further with this filler 18. It enables each of the solder ball of future groups to paste up easily with the solder ball of a front group by providing the bigger surface by which flattening was carried out

using an above-mentioned method.
[0021]In another examplethe filler 18 is removedafter a solder pillar is formed. The filler 18 is not used in another example. In this examplethe alignment fastener (alignment fixture) 24 as selectively shown in drawing 9 adjoins the solder ball 14 of the 1st groupand is arranged. The alignment fastener 24 is a thing of the type widely used in the pipe (tube) of 1 set of hollow by this technical field that has a pipe of one hollow every solder ball 14 of the 1st group most preferably preferably. The alignment fastener 24 is arranged so that the end of the side which is opening the pipe of each hollow may serve as substantially the surface where flattening of the solder ball 14 of the 1st group was carried out with the same flat surface.
[0022]The solder ball 22 of the 2nd group is installed on the solder ball 14 of the 1st group by moving the solder ball 22 of the 2nd group through the pipe of the hollow of the alignment fastener 24as shown in drawing 10. If it does in this waythe bigger surface which is provided with the filler 18 and by which flattening was carried out will become unnecessary. This is because the solder ball 22 of the 2nd group is prevented from rolling and falling from the solder ball 14 of the 1st group with the alignment fastener 24.
[0023]A reflow of it being carried out before the solder ball 22 of the 2nd group removes the alignment fastener 24and the solder ball 22 of the 2nd group dissolving by itand entering the space between the solder balls 14 of the 1st group is prevented. As for the alignment fastener 24since a reflow of the solder ball 22 of the 2nd group is performed before the alignment fastener 24 is removed preferablyit is preferred to be formed from the material which is not damp with the solder ball 22 of the 2nd group. Although the alignment fastener 24 is formed in the most suitable example using materialssuch as graphiteceramics or the other material is also used in another example.
[0024]The alignment fastener 24 is removed and drawing 11 shows the solder pillar after flattening of the solder ball 22 of the 2nd group was carried out so that it may be made in another example. This method of arranging the solder ball of two or more groups using the alignment fastener 24 is repeated until a solder pillar is formed in desired height. In a preferred embodimenta solder pillar is formed using the solder ball of about two to five group.
[0025]As mentioned abovein a preferred embodimentthe melting point of the solder ball of the group arranged henceforth [each]Rather than the melting point of the solder ball of the group arranged before itit is low and by it. when a problem arises in the arbitrary groups in the

group arranged suchit is not necessary to remove more groups which are needed for reconstructing a solder pillar from a solder pillar in each group -- at once -- one -- it is [group every] removable.
[0026]By manufacturing the package 10 which has a solder pillar using the method mentioned aboveas mentioned abovethe package which can absorb the shearing stress which accompanies fluctuation of temperature is obtained. This method and product made in this way can entrust the automated procedure which has already been widely used by the person skilled in the art easily.
[0027]Although the specific example of this invention was described especially by the abovethis invention is equally [to many processes known widely] applicable to a person skilled in the art.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]They are some sectional views of a grid array package.
[Drawing 2]They are some sectional views of the grid array package which the solder ball of the 1st group pasted up.
[Drawing 3]The solder balls of the 1st group are some sectional views of the grid array package by which a reflow was carried out.
[Drawing 4]The solder balls of the 1st group are some sectional views of the grid array package by which flattening was carried out.
[Drawing 5]They are some sectional views of the grid array package in which the filler was added between the solder balls of the 1st group.
[Drawing 6]Flux is some sectional views of the grid array package added to the solder ball of the 1st group.
[Drawing 7]They are some sectional views of the grid array package which the solder ball of the 2nd group pasted up.
[Drawing 8]The solder balls of the 2nd group are some sectional views of the grid array package by which a reflow was carried out.
[Drawing 9]They are some sectional views of the grid array package in which the alignment fastener has been arranged.
[Drawing 10]They are some sectional views of the grid array package in which the solder ball of the 2nd group was aligned.
[Drawing 11]A reflow of the solder ball of the 2nd group is carried outand they are some sectional views of the grid array package by which flattening was carried out.